Economic efficiency of production systems in the Gharb irrigated area (Morocco) affected by access to water resources

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Today, in the new context of water scarcity and climate change, governments limit the overexploitation of water resources and encourage the use of alternative resources (re-use of sewage, desalination, etc.). Groundwater merits particular attention due to its relative importance, especially in the coastal zone of the Gharb (Morocco). Indeed, due to the many different purposes for which they are used, groundwater resources and aquifers in different parts of the world are increasingly over-exploited.

It is consequently important to consider another system of resource management and to move away from supply management to demand management. This will make it possible to reduce total water demand by diversifying crops and sources of income and by introducing crops and activities with a higher added value, lower water requirements, higher income potential and more significant financial capacities. Farmers thus need to be encouraged to make more efficient use of irrigation water in growing crops. Demand management, particularly of large irrigation areas, offers considerable potential for water saving and conservation in the context of limited water resources and increasing mobilization costs.

This study was conducted in the Gharb irrigated area and was based on a survey of a sample of 50 farms with different crop systems (vegetables, citrus crops, cereals, fodder, sugar beet and sugar cane) and different irrigation systems (drip, sprinkler and gravity-fed), with the aim of calculating and comparing the economic efficiency indices of irrigated farms and the level of optimisation of irrigation water used for the main crops of the Gharb area. To this end, a Data Envelopment Analysis (DEA) model was used to calculate efficiency indices.

The results show that the most efficient farms are both those affected by water stress and those with "unlimited" access to water resources (private pumping). On the other hand, 73% of the farms are inefficient, indicating that the majority of farmers do not have a good grasp of the available technology.

The next step will be to confirm these results and to obtain partial efficiencies for each input. These partial efficiencies will enable us to explain why a particular crop is inefficient. It will then be possible to formulate more appropriate recommendations for farmers.

This approach should enable us to start by evaluating negative externalities such as environmental aspects (leaching of nitrates on a farm scale), and then to evaluate the efficiency of environmental outputs and to compare them with economic outputs.

Keywords: efficiency, water optimisation, Data Envelopment Analysis, production system, irrigation.